

Gilbert Chauvet

**Working in Integrative Physiology (circulation): the
PhysioMatica system.**

Abstract

The objective of this talk is to present a new integrative system, *PhysioMaticTM*, which leads to integrating any biological system of the organism. The cardiovascular system is presented as an element of this integrative software. It is considered as resulting from multiple cardiovascular subsystems (e.g. receptors, capillary beds), each one being described by a mathematical model in the framework of the MTIP (Mathematical theory of Integrative Physiology) already published.

The MTIP is based on: 1) a *representation*, constructed in terms of functional interactions. In this representation, the biological system is viewed as a set of hierarchical physiological functions, each level being defined by their time scale, which result in functional organization. Each function is represented in the structural organization in terms of space scales, and functional interactions propagate at each level through the structural units (e.g. neurons, receptors) that are points in abstract spaces of units. 2) a formalism, the S-propagators, that allows for the functional interactions to traverse levels of structural organization. An illustration is given with the central nervous system which shows the minimal number of couplings between different networks like neurons, astrocytes, capillaries and their connection with the cardiovascular system.

Finally, the computing system written in the MTIP framework appears as a time and space multiscale system that allows us to optimize the mathematical integration of large, non-linear and very complex dynamical systems.